GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Thermodynamics , PG_00055381		
Field of study	Mechanical Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	7.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jan Wajs	
	Teachers	dr inż. Marcin Jewartowski mgr inż. Stanisław Głuch mgr inż. Piotr Jasiukiewicz mgr inż. Kamil Stasiak dr hab. inż. Michał Klugmann dr inż. Waldemar Targański dr inż. Paweł Dąbrowski dr hab. inż. Jan Wajs	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	15.0	30.0	0.0	0.0	90
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	90	7.0	78.0	175

Subject objectives	Students acquire basic knowledge of thermodynamics in the dimension of theory and practice

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] is able to acquire information from specialized literary sources, databases and other resources, essential for solving engineering tasks; is able to compile the obtained information pieces and to interpret them, additionally is able to form conclusions and present justified opinion	Student uses graphs and tables of the physical properties to prepare laboratory reports. Student is able to interpret the results of measurements or calculations of energy balance for various machines. Student formulates opinions on the efficiency of thermodynamic cycles in heat engines.	[SU1] Assessment of task fulfilment
[K6_W02] possesses an organized knowledge on physics, including classic mechanics, acoustics, optics, electricity and magnetism, shows knowledge of the elements of quantum physics	Student possesses the knowledge needed to identify physical phenomena occurring in the simple thermodynamic systems (open and closed). On this basis, he correctly describes the types of energy conversion or transformation occurring in them.	[SW1] Assessment of factual knowledge
[K6_U06] is able to use mathematical and physical models for analysing the processes and phenomena occurring in mechanical devices within the range of material strength, thermodynamics and fluid mechanics	Student is able to use the thermal and caloric state equations of typical gases and steam. Student uses physical laws for simple heat transfer mechanisms. Student applies thermodynamic knowledge to describe the energy conversion processes in mechanical devices.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_W09] possesses basic knowledge within the range of thermodynamics and fluid mechanics, construction and operation of heat generating devices, process equipment, including renewable energy sources, cooling and air conditioning	Student defines basic concepts of thermodynamics, 1st and 2nd Law of Thermodynamics and equations of state of gases. Student analyzes the typical processes of ideal gas and steam, gas or steam cycles and heat transfer mechanisms. Student uses theory of the moist gases and explains air treatment processes for air conditioning. Student uses basic concepts of the thermodynamics of combustion. Student performs the measurements on an experimental setup, makes necessary calculations and presents the results in the form of tables and graphs. Student is able to analyze energy balance of various thermal machines.	[SW1] Assessment of factual knowledge

Subject contents

LECTURE: Basic concepts. The first law of thermodynamics. Ideal gas model. Properties of ideal, semi-ideal and real gases. Gas laws, thermal and caloric equation of state. Characteristic processes of ideal gas. Gas mixtures. Thermodynamic gas cycles. Entropy. The second law of thermodynamics and its consequences. Isobaric evaporation process. Properties of mono-component saturated steam. Properties of superheated steam. Characteristic processes of steam. Thermodynamic steam cycles. Gas mixtures and moist gases. Mollier diagram and the basic moist air processes. Fundamentals of refrigeration. Basics of compressor and sorption heat pumps. Elements of combustion thermodynamics.

EXERCISES: Simple conversion of energy, heat, work. The balances of power of open or closed thermodynamics systems. State and functions of state of ideal and semi-ideal gases and gas mixtures. Characteristic processes of gases. Gas thermodynamic cycles. Characteristic changes of steam. Calculations thermodynamic steam cycles.

LABORATORIES: Measurements of thermodynamic parameters: temperature and pressure. Determination of mass flow rate. Determination of air and water enthalpy. Energy balance of heat pump. Testing of the refrigerating unit. Determination of calorific value of solid and gas fuels. Energy balance of piston engine. Testing of the compressor.

Prerequisites and co-requisites

Knowledge from course of physics and mathematics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory reports	100.0%	20.0%
Middterm colloquiums	56.0%	30.0%
Written exam	56.0%	50.0%

Recommended reading	Basic literature	1. Y. Cengel, M. Boles, Thermodynamics An Engineering Approach, 8th Edition, Wiley, 2014. 2. M.J. Moran, H.N. Shapiro, D.D. Boettner, M.B. Bailey, Fundamentals of Engineering Thermodynamics 8th Ed., Wiley, 2014. 3. R. Mayhew, Engineering thermodynamics/Work & Heat Transfer. Wiley & Sons Inc. 1993, USA.
	Supplementary literature	no requirements
	eResources addresses	
Example issues/ example questions/ tasks being completed	Present equations of first law of thermodynamics. Describe Carnot Cycle. Describe Rankine / Otto / Diesel cycle. Present definitions of second law of thermodynamics. Operational principle of compressor heat pumps. Heating and humidification of air.	
Work placement	Not applicable	